VZ-200 TERMINAL

With the addition of a low cost V.21 modem this project will get your Dick Smith VZ-200 talking to the world! Designed and developed by the DSE Research and Development team at North Ryde, the ETI-695 must be the cheapest way to get a 300 baud glass terminal going yet.

THE VZ-200 was very good 'value for money' when it was released by Dick Smith Electronics a few years ago. The last batch sold was heavily discounted and no doubt many were snapped up by ETI readers, especially RTTY enthusiasts after the ETI-756 RTTY adaptor appeared in Nov/Dec '84. This project extends the VZ's capability to operate as a 300 baud serial terminal. Although the VZ-200 is no longer available the unit will also work with the latest VZ-300 computer which has an improved keyboard.

Construction

The pc board is designed to fit into a VZ expansion case which adds a professional finish to the project and is recommended. The case needs a bit of surgery to mount the DB-25S connector, so mark out the cut at the back of the 'top' half of the box (the larger piece). The connector sits flush with the lip of the half-case. Drill the two mounting holes for the DB-25S and screw it in with the 12 mm x 4BA screws and nuts.

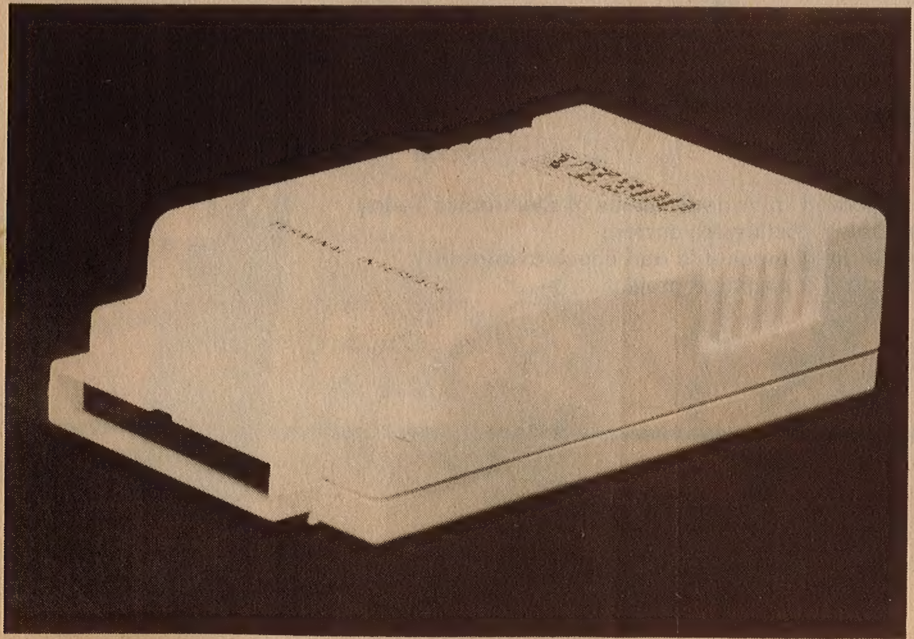
Check over the pc board before commencing construction, look for broken tracks, bridges and undrilled holes. The prototype pc board has been tinned and had a couple of holes covered by the solder. These are best handled by heating the spot with a soldering iron and a bit of solder wick, if you try and force the component leads through such blocked holes you run the risk of lifting the copper away from the board and breaking bits off.

Start off by soldering in the ten wire links. One of them is near a mounting hole and should be bent around the hole to leave it uncovered, the other nine links should be straight and tight.

The 44-way edge connector can go in next. It mounts from the component side of the board (of course). The solder tails should be pushed through the board so that the bottom of the plastic part of the connector is flush with the copper side of the pc board. This is necessary to fit the finished pc board correctly into the case, so make sure the connector is aligned before soldering.

Some of the resistors mount on their ends. Be careful not to bend the leads too close to the resistor body to avoid breaking the leads off.

Solder in the capacitors before the diodes, since the two electrolytic caps are a



PARTS LIST — ETI-695

NOTE — A complete kit of parts can be obtained from your Dick Smith store.

Resistors	all ¼ W, 5%
R1, 2, 3, 4, 10	4k7
R5, 12	1k
R6	33k
R7, 11	10k
R8, 9	3k3
R13	2k7
Capacitors	
C1, 2	100n ceramic
C3, 4	10n polyester (greencap)
C5, 6	100µ 16 V RB electrolytic
Semiconductors	
IC1	74LS138
IC2	2516 "VZRS" EPROM V1.5 or later
IC3	74LS74
IC4	74LS33
IC5	'555 timer
Q1	BC548
Q2	BC557
Q3	BD139 or BC639
D1, 2	1N60 Ge diodes
D3	1N914
D4, 5	1N4002

Miscellaneous
Printed circuit board "VZRS232"; VZ expansion case; 44-way female edge connector right angle pcb mounting; DB25S chassis socket; 2 x 12 mm 4BA screws and nuts; 24 pin DIP IC socket; tinned copper wire, hookup wire, solder, etc.

Price estimate: $49.95

wee bit close to diodes D4 and D5, which mount on their ends.

The two smaller transistors Q1 and Q2 can go in next, followed by Q3 which should be bent over if it is a BD139, as in the photograph. Solder the IC socket and the four ICs being careful to avoid solder bridges between the pins.

The three wires to the DB-25S connector were brought to the copper side of the pc board on the prototype; you may wire from the component side if you prefer before soldering.

Place the bottom half of the case down and push the 44-way connector through the slot in the end with the copper side of the pc board uppermost. Align the two pc board holes with the mounting pillars and fit the top half of the case. Finish with the case screws and the project is ready to test.

Testing

Make sure your VZ-200 is operating properly before connecting the project. The interface plugs into the memory expansion port which is the largest on the back of the computer. Power should be switched off while inserting or removing the unit.

Testing is best done with a 300 baud terminal (or another computer emulating one) otherwise you will have to call a friend or bulletin board with a modem. To actually communicate you have to enter the terminal mode from the menu by typing 0.

Providing the character length, parity and stop bits are identical you should have no trouble using the ETI-695 as a simple terminal.

We had some problems using the printer echo command with an Admate DP-80 printer using version 1.5 of the VZRS EPROM. This may be fixed in later versions, after our publication deadline. ▶

SOFTWARE OPERATION

The VZ terminal interface is totally software based. This text is to serve as a functional description of the operation of this software.

The software resides in an EPROM on the interface board and maintains a data area in RAM at 8000 hex. In this data area are the flags and values used by the terminal software. At power-up these values are set to pre-defined values of 8 data bits, 1 stop bit and no parity. The unit is 300 baud only.

After the power-up sequence has been completed, the software goes into a loop waiting for keyboard input from the user. At this time the user can select one of seven menu options, these are:

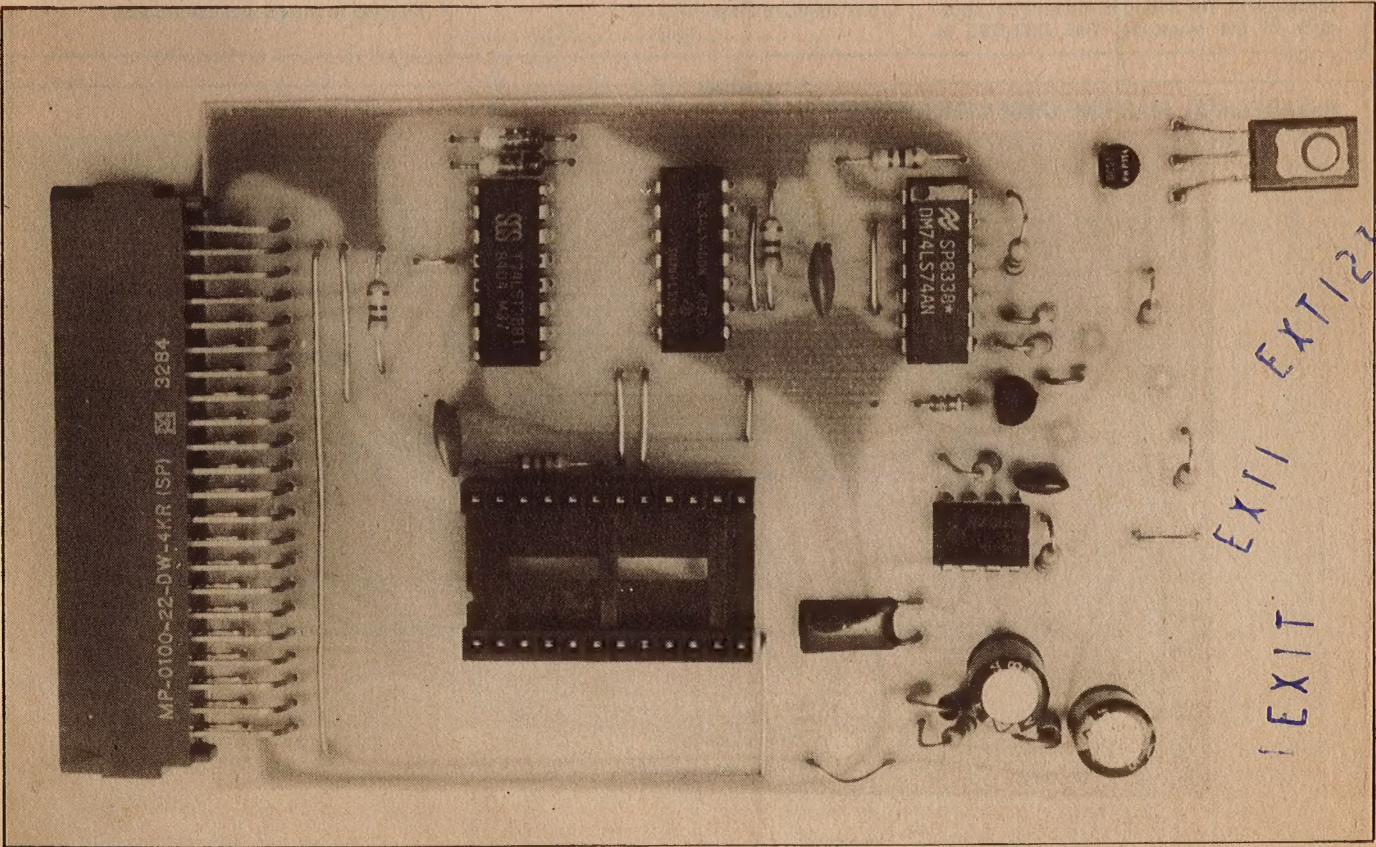
0) go to the terminal;
1) select full/half duplex;
2) toggle printer output on/off;
3) set number of data bits (7 or 8);
4) set number of stop bits (1 or 2);
5) set parity (odd, even or none);
6) set lf to cr option

If the user has selected one of the options 1-6, the appropriate action is taken and displayed on the screen. If option 0 is selected the software goes into terminal mode.

If the user selected option 0, the system begins looking for either keyboard input or incoming serial data. If a key has been pressed on the keyboard, then the software gets the value of that key, determines if it is a 'return to main menu' key (shift-x); if this is so it returns to the main menu, otherwise it sends the character to a routine that decodes it into bits and sends it serially to the interface hardware. It also adds start, stop and, optionally, parity bits. If the duplex option is set to half, it will echo to the screen as well.

If incoming serial data is found (by detecting a transition from a stop to a start bit), the software goes into a loop, reading bit seven of a port and encoding the incoming serial data bits into a byte, taking due consideration to the state of the start bit, stop bit(s) and optionally the parity bit. After a valid character is assembled it is sent to the screen and optionally to the printer.

The terminal operation continues until it detects a shift-x key, at which time it returns to the main menu.



HOW IT WORKS — ETI-695

The terminal interface provides a Dick Smith VZ-200 or VZ-300 computer with the hardware and software necessary to emulate a simple 300 bit/s terminal. The software supports full or half duplex operation and has a printer echo option to record the conversation.

THE VZ-200 COMPUTER

The basic VZ-200 computer employs a Z80 microprocessor running at a clock speed of 3.58 MHz. Two 8K x 8 mask-programmed ROMs contain the Microsoft BASIC interpreter, while three 2K x 8 static RAMs provide program memory.

A 6847P-1 video controller chip and a further 2K x 8-bit static RAM form the heart of the computer's video section.

A simple software scanning scheme is used for the keyboard. The keys are arranged in eight rows, each of which can be pulled down to low logic level by diodes connected to the eight least significant address lines (A0-A7). The other sides of the keys are connected to six column lines, which are connected to six of the inputs of a gated octal buffer, and also to six pull-up resistors. The octal buffer's outputs are connected to the six least significant data lines of the processor (D0-D5).

Simplified decoding is used for selection of the various I/O devices in memory space. The memory address ranges occupied are as follows (in hexadecimal notation):

VZ-200 MEMORY MAP (WITH TERMINAL)

- 0000-1FFF basic ROM 0
- 2000-3FFF basic ROM 1
- 4000-47FF terminal EPROM
- 4800-4FFF spare space, can be used with 2532 EPROM
- 5000-57FF receive data, data on data bit 7
- 5800-5FFF transmit data latch, data sent on data bit 7
- 6000-67FF not used in terminal
- 6800-6FFF keyboard, cassette interface, speaker, VDC
- 7000-77FF video RAM
- 7800-8FFF inbuilt user RAM
- 9000-FFFF reserved for memory expansion modules

Note that due to the simplified addressing, the output latch serving the cassette output, speaker and video display controller effectively occupies all addresses from 6800-6FFF inclusive. Similarly the keyboard/cassette input buffer also occupies all of this address range, although the individual rows of keys effectively occupy discrete addresses.

For more information on the VZ-200 consult the *VZ-200 Technical Reference Manual* available from Dick Smith Electronics.

THE TERMINAL HARDWARE

The project connects to the VZ-200 through the memory expansion connector (P2) and is memory mapped.

IC1 decodes the Z-80's address lines to provide select signals for the EPROM IC2, the transmit latch IC3 and the receive data gates.

The incoming RS232 signal is converted from a −12/+12 volt signal to a TTL compatible signal by T1, thence to IC4 where it is gated with the 5000-57FF enable signal. If this enable signal is true (active low) the received data is inverted and fed to data bit D7 where it is read by the terminal software.

The outgoing TTL signal is sent from data bit D7 to IC3 where it is latched. The clock for IC3 is provided by gating the processor write enable with the 5800-5FFF output from IC1. The output from IC3 is level shifted by T2 and T3 to obtain an RS232 compatible signal. The negative voltage used by T3 is generated in a charge pump circuit based on IC5, a '555 timer.

SOURCE CODE

A complete documented source code listing of the software will be available on the Dick Smith Bulletin Board in the near future (according to Steven Engels of Dick Smith Electronics). The listing is too long to reproduce in the magazine. THE DSE-BBS is reached on: (02)887-2276 within Australia; +61 2 887-2276 on ISD.

The DSE-BBS is online 24 hours except on Fridays between 3 pm and 5.30 pm Eastern Standard Time.

TECHNICAL INQUIRIES

As the complete project including software was developed at DSE, all inquiries about the VZ-200 terminal project should be directed to Dick Smith Electronics.

HEXADECIMAL MACHINE CODE LISTING VZ-RS V1.5

```
ADDR   0  1  2  3   4  5  6  7   8  9  A  B   C  D  E  F

0100:  AA 55 E7 18  C3 84 41 4F  4E 20 4F 46  46 46 55 4C
0110:  4C 48 41 4C  46 0C 56 5A  2D 32 30 30  2F 33 30 30
0120:  20 52 53 2D  32 33 32 20  2D 20 56 45  52 53 49 4F
0130:  4E 20 31 2E  35 0D 28 43  29 20 31 39  38 35 20 44
0140:  49 43 4B 20  53 4D 49 54  48 20 45 4C  45 43 54 52
0150:  4F 4E 49 43  53 0D 2D 2D  2D 2D 2D 2D  2D 2D 2D 2D
0160:  2D 2D 2D 2D  2D 2D 2D 2D  2D 2D 2D 2D  2D 2D 2D 2D
0170:  2D 2D 2D 2D  2D 0D 30 5D  20 45 4E 54  45 52 20 54
0180:  45 52 4D 49  4E 41 4C 0D  31 5D 20 46  55 4C 4C 2F
0190:  48 41 4C 46  20 44 55 50  4C 45 58 3A  00 46 55 4C
01A0:  4C 0D 32 5D  20 54 4F 47  47 4C 45 20  50 52 49 4E
01B0:  54 45 52 20  20 3A 4F 46  46 0D 33 5D  20 53 45 54
01C0:  20 23 20 44  41 54 41 20  42 49 54 53  20 3A 38 20
01D0:  20 0D 34 5D  20 53 45 54  20 23 20 53  54 4F 50 20
01E0:  42 49 54 53  20 3A 31 20  20 0D 35 5D  20 53 45 54
01F0:  20 50 41 52  49 54 59 20  20 20 20 20  20 3A 4E 20

ADDR   0  1  2  3   4  5  6  7   8  9  A  B   C  D  E  F

0200:  20 0D 36 5D  20 41 44 44  20 4C 46 20  54 4F 20 43
0210:  52 20 20 20  20 3A 4F 46  46 0D 0D 2A  2A 2A 2A 2A
0220:  2A 2A 20 57  48 45 4E 20  49 4E 20 54  45 52 4D 49
0230:  4E 41 4C 20  2A 2A 2A 2A  2A 2A 2A 2A  20 20 53 48
0240:  49 46 54 20  2D 20 58 20  54 4F 20 45  58 49 54 20
0250:  54 45 52 4D  49 4E 41 4C  20 20 2A 2A  2A 2A 2A 2A
0260:  2A 2A 2A 2A  2A 2A 2A 2A  2A 2A 2A 2A  2A 2A 2A 2A
0270:  2A 2A 2A 2A  2A 2A 2A 2A  2A 2A 2A 00  00 00 00 00
0280:  00 00 00 00  F3 31 00 90  21 9D 40 11  00 80 01 E7
0290:  00 ED B0 3A  E1 80 F5 3E  01 32 E1 80  21 15 40 CD
02A0:  4D 43 21 00  80 CD 4D 43  F1 32 E1 80  CD 50 34 21
02B0:  93 41 E5 CD  66 44 B7 28  FA D6 30 38  F6 FE 07 30
02C0:  F2 21 CE 41  87 5F 16 00  19 5E 23 56  EB E9 56 42
02D0:  DC 41 F7 41  38 42 47 42  0B 42 01 42  3A E0 80 B7
02E0:  3E 01 21 11  40 28 04 AF  21 0D 40 32  E0 80 11 00
02F0:  80 01 04 00  ED B0 C9 21  DF 80 11 19  80 CD 21 42

ADDR   0  1  2  3   4  5  6  7   8  9  A  B   C  D  E  F

0300:  C9 21 E1 80  11 79 80 CD  21 42 C9 3A  61 80 FE 4E
0310:  0E 45 28 08  FE 45 0E 4F  28 02 0E 4E  79 32 61 80
0320:  C9 7E B7 3E  01 28 01 AF  77 21 0A 40  B7 28 03 21
0330:  07 40 01 03  00 ED B0 C9  3A 31 80 FE  37 3E 38 28
0340:  02 3E 37 32  31 80 C9 3A  49 80 FE 31  3E 32 28 02
0350:  3E 31 32 49  80 C9 CD 56  43 CD 1D 43  20 0E CD 8F
0360:  42 CD 6E 43  4F 3A DF 80  B7 C4 53 44  CD 66 44 B7
0370:  28 E7 FE 65  C8 F5 CD C6  42 F1 4F 3A  E0 80 B7 79
0380:  28 D7 CD 6E  43 4F 3A DF  80 B7 C4 53  44 18 CA CD
0390:  2E 43 CD 23  43 3A 31 80  D6 30 5F 06  08 0E 00 78
03A0:  FE 01 20 07  7B FE 08 28  0E 18 0E 3A  00 50 E6 80
03B0:  B1 4F CB 39  CD 23 43 10  E6 CD 3A 43  3A 61 80 FE
03C0:  4E C4 23 43  79 C9 F5 3E  FF 32 00 58  CD 23 43 3A
03D0:  31 80 D6 30  47 F1 F5 4F  CB 39 3E 00  38 02 3E 80
03E0:  32 00 58 CD  23 43 10 F0  F1 4F 3A 61  80 FE 4E 28
03F0:  1C 79 B7 3A  61 80 E2 03  43 FE 45 3E  80 28 08 3E
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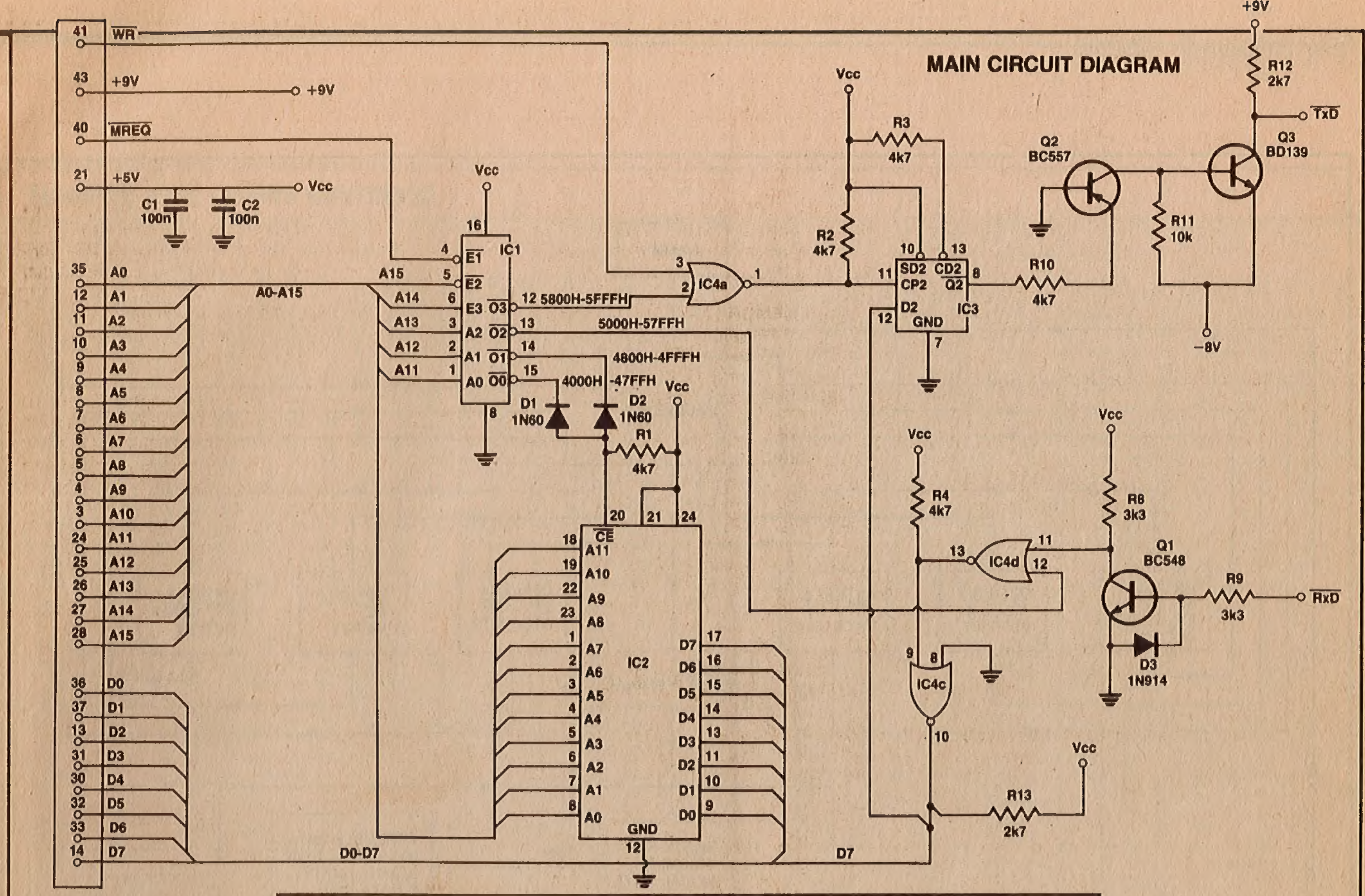
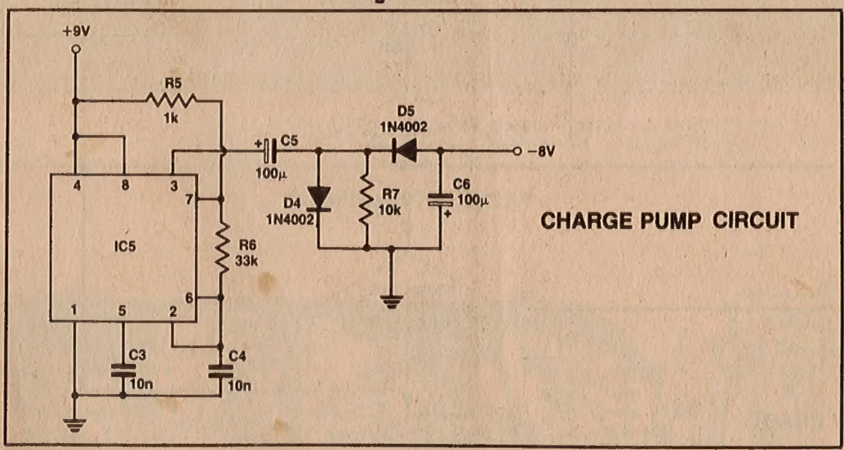
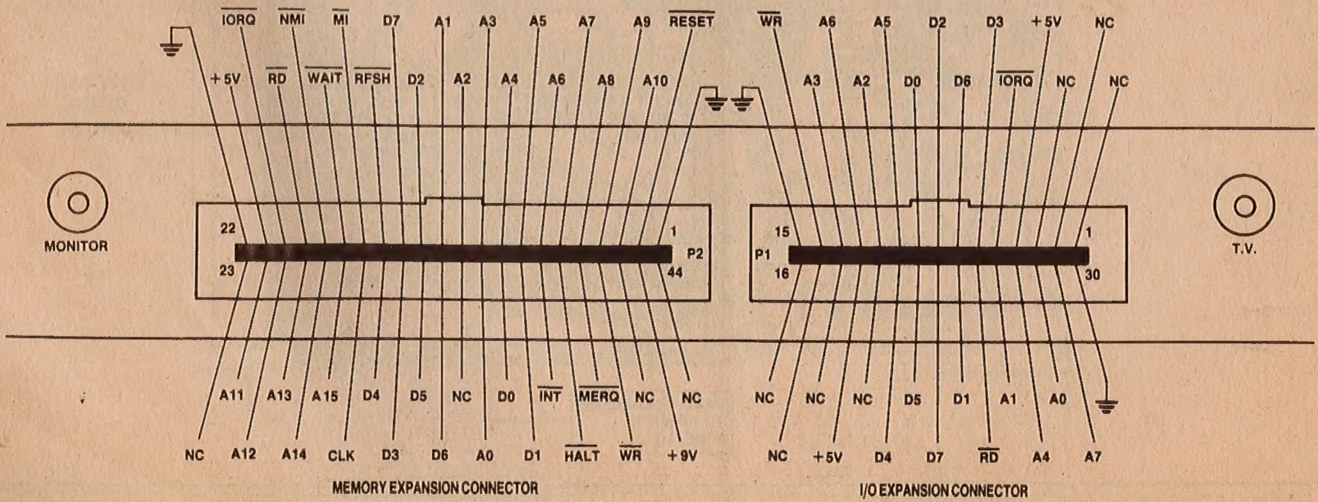
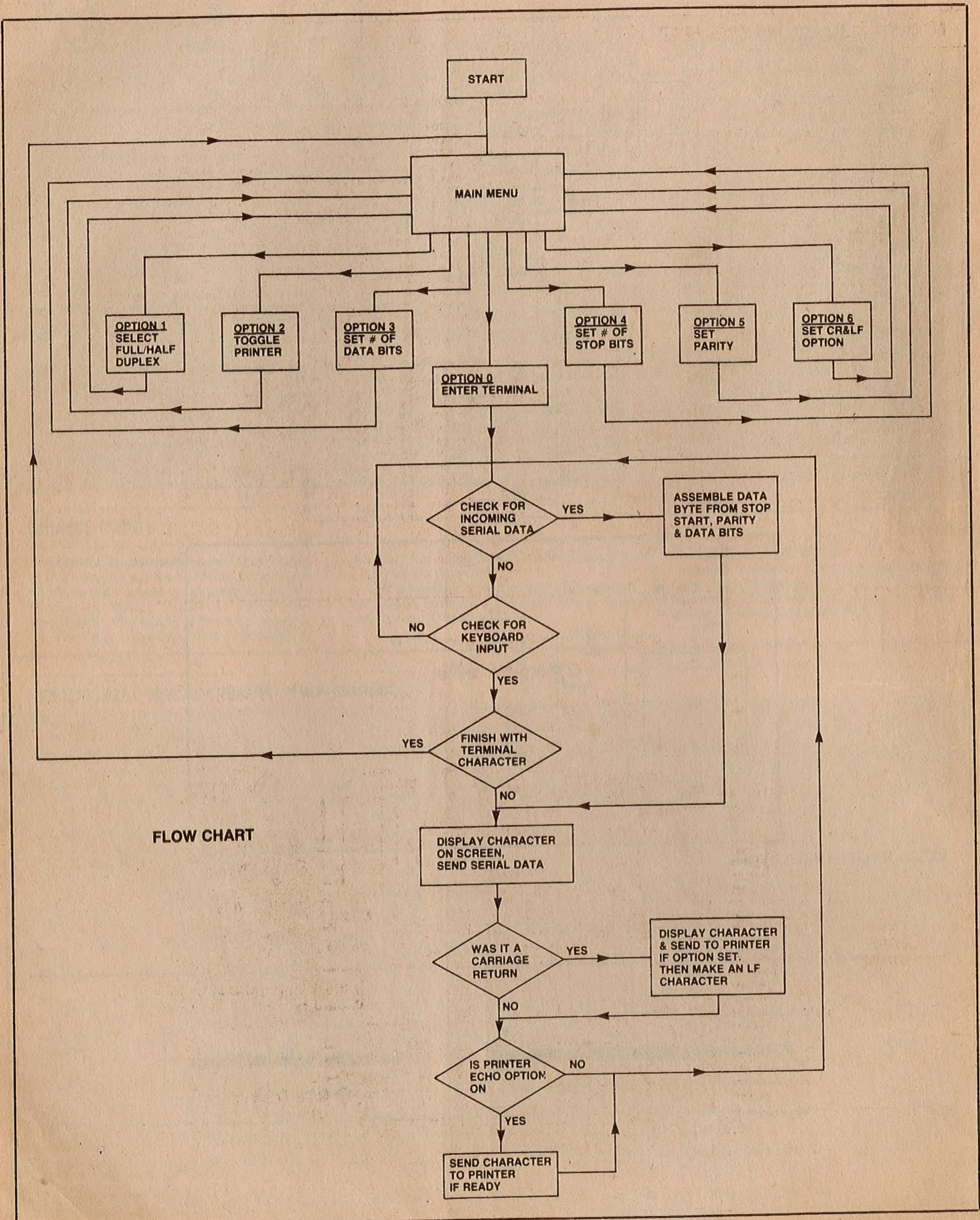




VZ-200 REAR PANEL LAYOUT




START
MAIN MENU
OPTION 1
SELECT
FULL/HALF
DUPLEX
OPTION 2
TOGGLE
PRINTER
OPTION 3
SET # OF
DATA BITS
OPTION 4
SET # OF
STOP BITS
OPTION 5
SET
PARITY
OPTION 6
SET CR&LF
OPTION
OPTION 0
ENTER TERMINAL
CHECK FOR
INCOMING
SERIAL DATA
YES
ASSEMBLE DATA
BYTE FROM STOP
START, PARITY
& DATA BITS
NO
CHECK FOR
KEYBOARD
INPUT
NO
YES
FINISH WITH
TERMINAL
CHARACTER
YES
NO
DISPLAY CHARACTER
ON SCREEN,
SEND SERIAL DATA
WAS IT A
CARRIAGE
RETURN
YES
DISPLAY CHARACTER
& SEND TO PRINTER
IF OPTION SET.
THEN MAKE AN LF
CHARACTER
NO
IS PRINTER
ECHO OPTION
ON
NO
YES
SEND CHARACTER
TO PRINTER
IF READY

FLOW CHART

MACHINE CODE LISTING CONTINUED

ADDR	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0400:	00	18	04	FE	4F	18	F4	32	00	58	CD	23	43	3A	49	80
0410:	D6	30	47	AF	32	00	58	CD	23	43	10	F7	C9	3A	00	50
0420:	CB	7F	C9	F5	C5	CD	2E	43	CD	2E	43	C1	F1	C9	C5	3E
0430:	23	06	0B	10	FE	3D	20	F9	C1	C9	CD	2E	43	C5	3E	22
0440:	18	EF	F5	C5	01	FF	4F	CD	60	00	C1	F1	C9	7E	B7	C8
0450:	CD	6E	43	23	18	F7	21	00	70	22	E5	80	11	01	70	01
0460:	FF	01	36	60	ED	B0	AF	32	E4	80	32	00	68	C9	F5	E5
0470:	C5	D5	CD	7A	43	D1	C1	E1	F1	C9	ED	5B	E5	80	FE	0C
0480:	28	D4	FE	0D	28	7E	FE	08	28	35	FE	09	28	16	FE	0A
0490:	28	4A	FE	07	CA	50	34	CB	7F	20	08	FE	20	F8	CD	5D
04A0:	44	CB	F7	12	13	ED	53	E5	80	3A	E4	80	3C	32	E4	80
04B0:	FE	20	F8	CD	F3	43	3A	DF	80	B7	C8	CD	49	44	C9	3A
04C0:	E4	80	B7	28	0A	3D	32	E4	80	1B	ED	53	E5	80	C9	E5
04D0:	21	00	70	B7	ED	52	E1	C8	3E	1F	18	EA	3A	E4	80	4F
04E0:	06	00	C5	CD	F3	43	C1	EB	09	EB	ED	53	E5	80	79	32
04F0:	E4	80	C9	3A	E1	80	F5	3E	01	32	E1	80	CD	04	44	F1

ADDR	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0500:	32	E1	80	C9	E5	EB	3A	E4	80	5F	16	00	B7	ED	52	3A
0510:	E1	80	B7	28	04	11	20	00	19	EB	21	00	72	B7	ED	52
0520:	28	0A	ED	53	E5	80	AF	32	E4	80	E1	C9	21	20	70	11
0530:	00	70	01	E0	01	ED	B0	21	E0	71	11	E1	71	01	1F	00
0540:	36	60	ED	B0	11	E0	71	18	D9	CD	C4	05	CB	47	C0	CD
0550:	E2	3A	C9	CD	C4	05	CB	47	C0	79	C3	8D	05	FE	61	D8
0560:	FE	7B	D0	E6	5F	C9	21	FE	68	0E	08	06	06	7E	F6	04
0570:	1F	30	58	10	FB	CB	05	0D	20	F1	06	04	21	DF	68	7E
0580:	CB	57	28	3D	CB	05	7E	CB	57	28	3A	CB	05	CB	57	28
0590:	38	CB	05	CB	05	7E	CB	57	28	11	CB	05	7E	CB	57	28
05A0:	11	3E	FF	32	E2	80	AF	32	E3	80	C9	3A	E3	80	CB	D7
05B0:	18	05	3A	E3	80	CB	CF	32	E3	80	3E	FF	32	E2	80	AF
05C0:	C9	0E	03	18	06	0E	02	18	02	0E	01	21	05	45	1E	00
05D0:	3A	E3	80	CB	57	28	04	1E	60	18	06	CB	4F	28	02	1E
05E0:	30	3E	08	91	4F	3E	06	90	47	CD	FA	44	83	06	00	4F
05F0:	09	7E	21	E2	80	BE	28	C7	77	C9	AF	B9	28	05	C6	06

ADDR	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0600:	0D	20	FB	80	C9	54	57	20	45	51	52	47	53	20	44	41
0610:	46	42	58	20	43	5A	56	35	32	20	33	31	34	4E	2E	20
0620:	2C	20	4D	36	39	2D	38	30	37	59	4F	0D	49	50	55	48
0630:	4C	3A	4B	3B	4A	00	00	00	00	00	00	00	00	00	00	00
0640:	00	00	65	00	00	00	00	25	22	20	23	21	24	00	3E	00
0650:	3C	00	5C	26	29	3D	28	40	00	00	00	00	00	00	00	00
0660:	3F	2A	2F	2B	00	14	17	00	05	11	12	07	13	00	00	01
0670:	06	02	18	00	03	1A	16	00	00	00	00	00	00	0E	00	00
0680:	00	00	0D	00	00	00	00	00	00	19	0F	00	09	10	15	08
0690:	0C	00	0B	00	0A	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06A0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06B0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06C0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06D0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06E0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06F0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

ADDR	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0700:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0710:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0720:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0730:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0740:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0750:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0760:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0770:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0780:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0790:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07A0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07B0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07C0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07D0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07E0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07F0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

COMPONENT OVERLAY